these as 0002, or, possibly, 00021. There is very little to choose between the two methods except as to the ease in writing, speaking and printing.

As to the classification or arrangement of subjects, my personal preference would be strongly in favor of a simple dictionary catalogue.

Cleveland Abbe.

THE STOKES JUBILEE.

On June 1 and 2, 1899, the University of Cambridge celebrated the fiftieth anniversary of the appointment of Sir George Gabriel Stokes to the Lucasian professorship of mathematics in that institution. During the half century of his connection with Cambridge, Professor Stokes has distinguished himself by a remarkable series of investigations in the fields of hydromechanics, physical geodesy, elasticity, the undulatory theory of light, and pure mathematics. His activity has continued down to the present date, one of his most recent papers dealing with the mechanical properties of the X-rays.

The celebration of so rare an event in academic life, and the eagerness of educational and scientific institutions to render homage to so eminent a man, naturally brought together a large body of specialists in the mathematico-physical sciences. About 400 delegates and other guests were present. Nearly all of these were entertained either in the colleges or in the homes of members of the professorial staff. Thus was it made easy for the stranger within the gates of this renowned University to see much of its inner life and to enjoy in the fullest degree its charming hospitality.

The ceremonies began on the afternoon of June 1st, with the Rede Lecture, delivered in the Senate House, by Professor Cornu, on 'The wave theory of light; its influence on modern physics.' This was delivered with admirable clearness in French. In the evening following a conversazione was held in Fitzwilliam Museum, and busts of Sir George Stokes were presented to the University and to Pembroke College (that of Stokes) by Lord Kelvin.

On the morning of June 2d the delegates and guests were received in the Senate House by the Vice-Chancellor and the delegates presented the addresses sent by the various academic and scientific institutions. There were about seventy such addresses, so that it was essential to dispense with the formal reading of them in most cases. Professor Stokes responded briefly and with great modesty to these addresses, saying that they made him feel that in his long life he ought to have accomplished much more; but, he added, humorously: If I had done more I probably should not have lived to celebrate this jubilee.

On the afternoon of June 2d the address of the University of Cambridge and a gold medal were presented to Sir George Stokes; and immediately thereafter the degree of Doctor in Science, *honoris causa*, was conferred on the following distinguished men of science: Marie Alfred Cornu, professor of experimental physics in the École Polytechnique, Paris; Jean Gaston Darboux, dean of the faculty of sciences in the University of Paris; Albert Abraham Michelson, professor of experimental physics in the University of Chicago; Magnus Gustav Mittag-Leffler, professor of pure mathematics, Stockholm; Georg Herman Quincke, professor of experimental physics in the University of Heidelberg; and Woldemar Voigt, professor of mathematical physics in the University of Göttingen.

SCIENTIFIC BOOKS.

A Text-Book of Physics—Sound. By J. H. Poynting and J. J. Thomson. London, Charles Griffin & Co. 1899. Pp. 163.

This is the first one of five volumes in

course of preparation by the authors, the others relating to 'Properties of Matter,' 'Heat,' 'Magnetism and Electricity,' and 'Light,' respectively.

These text-books are intended "chiefly for the use of students who lay most stress on the study of the experimental part of physics, and who have not yet reached the stage at which the reading of advanced treatises on special subjects is desirable." The nature of sound and its chief characteristics are first considered in a chapter that is wholly free of mathematics. The velocity of sound in air aud other media is then discussed, the reflection and refraction of sound, frequency and pitch of notes, resonance and forced oscillations, the analysis of vibrations by Fourier's theorem, the transverse vibrations of stretched cords, longitudinal vibrations in pipes and other air cavities, vibration of rods, plates and membranes, the Trevelyan rocker, sensitive flames and musical sand. The last chapter is on the superposition of waves, with application to the physical basis of concord and discord, and on combination tones.

The distinguished authors are so well known for their original and accurate work as investigators that the critic who is in search of mistakes will find little to note, beyond a very small number of obvious typographical errors. In the descriptive parts the style is clear and the paragraphing is good. A majority of the illustrations are in the form of diagrams. In the mathematical parts the use of calculus is wholly avoided.

In judging the practical value of a text-book it is necessary to take into view a number of considerations which have no place in connection with what is intended for the advanced reader. Regard must be had also for differences of educational method in different countries. If instruction is given by lectures entirely the text-book is merely an accompaniment for private reading. But if the text book is to be a drill book, as is, perhaps, most frequently the case in America, and especially if much of its contents be mathematical, it will almost surely be unsatisfactory unless prepared by one who has had much experience, not merely in the art of presentation, but especially in that of testing the student's success in acquisition. At the outset there must be a clear understanding as to the amount of preliminary knowledge that can be reasonably assumed on the part of the student. It is a matter of common observation that a mathematical genius is rarely ever a good mathematical teacher, because he usually fails to appreciate the difficulties experienced by those who are less gifted than himself. Even when the teaching is to be not oral, but by use of the printed page, it is wonderfully easy to express mathematical truths in such form as to put them quite beyond the grasp of a fairly intelligent student.

It is not in the domain of acoustic science, but in the art of text-book adaptation that the present volume is found somewhat wanting. If the reader can be assumed to possess already a good knowledge of general physics he will find much to interest him. But if he is to obtain his introduction to acoustics through the medium of this text-book he will not proceed very far without becoming discouraged. Underived formulas are employed so frequently that the reader who does not recognize them is justified in being impatient. He takes little satisfaction in reading that an unfamiliar mathematical statement 'can be proved;' or that it 'can be shown from the equation, etc.,' which in turn 'can be reduced to' another unrecognized form. Such statements are, of course, occasionally necessary, but in a text-book their use should be reduced to a minimum. In the great majority of cases such demonstrations amount to no demonstration at all. It is readily perceived that the author has gone through the requisite mathematical work, but does not wish to cumber his page with the details that are indispensable to a clear understanding of the subject by the student.

In a mathematical text-book, whether this term be applied to pure mathematics or to a book involving the applications of mathematics, it is of the utmost importance that all paragraphs shall be numbered, that equations shall also be numbered, and that the relation between new and old topics shall be indicated by frequent cross references. Attention to such details increases the labor of composition for the author, while the neglect of them greatly

magnifies the labor which hundreds of readers are compelled to undergo. They are wholly neglected in the present volume.

There are certain topics in acoustics which require the use of calculus for satisfactory treatment, but of which the practical results are so important that these cannot be omitted in an elementary treatise. Such, for example, is the equation expressing the relation between velocity of propagation, elasticity and density. For propagation of longitudinal waves the method of deduction without higher mathematics, first brought out by Rankine thirty years ago, is well known. In the present text-book an independent method is employed in which the formula is briefly deduced by discussion of the displacement curve for a longitudinal disturbance. Laplace's correction is satisfactorily explained, but in the application to numerical examples the student is required to apply thermodynamic principles, with which certainly the elementary student cannot be assumed to be familiar, but which will, doubtless, be explained in the future volume on 'Heat.'

The chapter on 'Frequency and Pitch of Notes' is particularly good. In the discussion of musical quality and of concord and discord prominence is justly assigned to the masterly researches of Helmholtz, but very little attention is given to the work of Rudolph König. In like manner the work of Mayer in America fails to receive any mention. The discussion of singing flames will be found better than in most text-books, including an excellent exposition of Lord Rayleigh's investigation on this subject.

On the whole the book is much to be commended to those who are already acquainted with the priciples of acoustics and who wish a modern presentation of the subject by men of high standing. For a class text-book, as commonly employed in America, it will scarcely be found well adapted.

W. Le Conte Stevens.
Washington and Lee University.

Photographic Optics. By R. S. Cole, M.A. New York, D. Van Nostrand Co. 1899. Pp. 330.

The aim of this handbook, which was originally published in England by Samson Low, Marston & Co., is to give an elementary presentation of such of the problems of optics as find application in practical photography. A careful perusal of the book leaves in the reviewer's mind the impression that the emphasized word in the title should be 'optics' and not 'photographic;' that is, 'photographic' in the sense that most American amateur photographers would use the word. The book is written from the standpoint of the student of optics rather than that of the up-to-date practical photographer.

The photographer will find given in the various chapters of the book an excellent treatment of the various optical conditions encountered in using the camera, and this treatment is thorough and made as simple as the nature of the subject will admit; the author going back to first principles in all possible cases.

Perhaps the most important section is the one on lens testing, which contains an account of the tests employed at the Kew Observatory. Photographers are too apt to assign the same degree of excellence to all lenses of the same make; but the fact is that no manufacturer turns out two lenses just alike.

The photographic-lens industry is assuming such large proportions in this country that some one of our institutions ought to establish a lens-testing department which shall duplicate here the work of the Kew Observatory in England, so that when the practical photographer buys his lens he can receive with it a certificate of excellence.

We could wish that Mr. Cole had given us detailed information in regard to the construction and use of the various modern lens combinations, such as the Zeiss, Goerz and Steinheil lenses. These are points on which the ordinary amateur photographer is utterly ignorant, and even a modest amount of enlightenment would be of great benefit to him.

The author certainly dismisses too abruptly the subject of calculating the brightness of the image and timing exposures. It is not such a wholly empirical matter as is represented. Our best amateur photographers do calculate as accurately as possible the time of their exposures, and their results warrant this expendi-